Waste Reduction 2008 Task Force
Background Paper

Some general process features of composting and making mulch

Introduction:

High on the EPA's current list of waste streams to divert from landfilling, to beneficial use are those materials that are "biodegradable". That is, they "rot", and thus are the major emitters of landfill gasses such as methane. Methane is more than 20 times more damaging to the ozone layer than carbon dioxide. To avoid/reduce methane production from these materials, both physical and biological processes are used to convert waste streams such as yard trimmings (twigs, branches, limbs…plus autumn leaves and summer grass), as well as food waste from supermarkets and restaurants (free-standing or associated with various institutions or activities) into a ground product, i.e., mulch, or into a quite thoroughly decomposed (well rotted) product, i.e., compost. For purposes of this paper, we shall set aside "backyard composting" as a special activity pursued by a very small fraction of the residential population. These are truly dedicated individuals typically living in detached, usually single family dwellings…who like to garden, not just endure lawn mowing!

Physical preparation of mulch:

Mulch is any material that sits on top of the soil. A layer of closely knit, small colorful stones (or even old pop bottle caps!) qualify as mulch. We are interested in the type of mulch prepared from grinding woody yard trimmings and/or land clearing debris. Anyone in Tennessee can purchase a grinder or shredder and get into the mulch making business. There are few regulations regulating the production of mulch. That's the good news. The more challenging aspect of mulch making comes in the storage of the ground material until it is sold. Why is storage a challenge? The short answer is: some mulch making facilities do not have a lot of area in which to operate, so the operators have to create large piles of the ground material. And then to fit even more material in the storage area, the operators use heavy equipment (bulldozers and the like) to compact the ground material so they can make the piles very high…often greater than 20 - 30' high. These high, densely packed piles of ground yard trimmings---as well as stored compost, but to a much lesser extent---can lead to *spontaneous combustion* (SC). That is, parts of the piles, usually toward the pile interior, get very hot and begin to smolder. Smoldering can lead to outright fires. For a bedtime story about the biological and chemical causes the lead to SC at composting and mulch making facilities, you may read (yawn…) the reference that follows…especially if you are in need of a very good night's sleep!! But wait, what's more important is that as academically fascinating as SC is to some, it is quite easy to avoid…a point of more than interest for the site operators who should be striving to avoid SC. Simply put, "*small* (pile size) *and wet* (versus dry ground material) *is beautiful*". Some site operators may know that wet piles are the objective, but during very dry summers like parts of Tennessee have experienced over the past few years, storage piles may get too dry. Water rationing amongst the citizenry and businesses…including mulch-making/composting sites as well…may lead to the unfortunate arrival of the local fire department at mulch making sites. In such cases, if one cannot opt for wet, then the other

option is small, i.e., >12-15' high piles. SC is a 20 year old problem across the US, not only at some sites in Tennessee.

A special mention about autumn leaves and summer grass…

While these two waste streams may be counted as items to be included in "yard trimmings", or at least "other yard debris", they are really more similar to lettuce and parsley or pea vine and string bean leaves than woody stems, branches and limbs that we discussed above. In fact, they don't have to be ground at all to be converted into a beneficial product called compost. As this is the case, we will include these to materials in the section below on "composting".

Composting is: . . manipulated rotting carried out in piles of "stuff" that rots

The title of this section contains two important words: *rotting* and *piles*. First, rotting, we all know that rotting is one of Mother Nature's natural processes. We try to prevent rotting in the timbers of older homes in Tennessee. Forest leaves drop to the ground in the fall and within a year or two become part of the forest floor … that wonderful smelling humus that makes up the rich productive top soil of the future. So what are examples of "stuff" in our daily lives that rots? You already know: the oozing old potatoes and the onions in the lower refrigerator drawer, the fruit with the brown/black spots, the lettuce that turns from crisp to runny, the cabbage that develops the well known "stink", even the cellulose sponge on the kitchen sink that gradually smells "funky" and falls apart during a hard scrubbing of a pot. There is an important fact to add. Bacteria cause the rotting in all of the above items, and these *bacteria generate heat during the rotting process*…much as we generate a lot of heat when we go for a mile run. The heat that bacteria generate cannot be felt when we touch the rotting areas of the items above.
When one puts things that are ready to rot into a pile, a very interesting and important observation can be witnessed. The pile of rotting things starts to warm! Put any living things in cramped quarters and the temperature measured inside the cluster will start to rise, e.g., picture 10 people cramped into an old telephone booth! So here we have the effect of "piles" of rotting materials, i.e., heat accumulation inside the pile.

At composting facilities, the site operators create piles of materials that rot. Voila…the piles start to warm up…and temperatures are well above the temperature in the air outside the pile. Let's forget about the details of "how hot" and "how long"…these are US Environmental Protection Agency and/or Tenessee-regulated requirements. The main point is, COMPOST is the final product (after a multi-stage, 6-9 months) of the "composting process" at these Tennessee-state approved sites. It is important to remember that the act of composting is best thought of, as the *managed* decomposition of organic matter.

If it rots, bring it on…!

OK, we'll bring it on. Food waste from restaurants can be composted (when mixed with ground wood waste). So can so-called "biosolids" (sewage sludge) produced as a byproduct at wastewater treatment plants. The "dumpings" of animals in local zoos have been composted for years, especially on the west coast of the US. Leaves and grass are routinely composted.

The UNINTENDED CONSEQUENCE…

While rotting is ACKNOWLEDGED to occur at composting facilities…and Tennessee has regulations that assure the proper operation of composting facilities…the SAME HEATING PROCESS OCCURS AT MULCH MANUFATURING FACILITIES and these facilities are unregulated by the state or EPA. That is, the "same process" means that heating of piles of ground yard trimmings occur, and the heating is caused by the same kinds of bacteria that rot fruits and vegetables! So what's the big deal about the pile warming process? In general the problem may be summarized by saying that the "level of knowledge" required to operate a composting facility is quite extensive and deals with the "biology, chemistry and physics" that lead to pile heating (sounds complicated, but it isn't). However, as simple as the heating process is, operators operating grinding operations are not required to grasp these basic facts. Yet, these facts are needed to prevent SC at yard trimmings facilities, i.e., to realize the importance of water (wet) and pile size (small). As stated above, composting facilities in Tennessee are permitted by TDEC Division of Solid Waste Management. TDEC also has regulations governing the quality of compost (it's not necessary to go into those regulations here).

Yard waste grinding operations in TN (examples):

Williamson County
Knox County
Knoxville

Numerous others (?)…unregulated, so they are not generally know outside the local population(s) that they serve.

Composting facilities in Tennessee (examples):

Leaves: Memphis, Brownsville, Harriman…University of Tennessee (Knoxville campus)
Food waste: Correctional facilities across TN, especially the 4 prisons in Nashville. TN; Sevierville, TN
Biosolids (sewage sludge) – Lenoir City

Spontaneous combustion reference:

Buggeln, R. & R. Rynk. 2002. **Self-heating in yard trimmings: conditions leading to spontaneous combustion**. *Compost Science & Utilization 10(2): 162-182.*

To be determined by the Task Force

Focus Questions:

1. Should composting and mulching be a part of the mandated municipal solid waste region's waste reduction goal? To what extent?

2. Should composting and mulching be considered as part of a completely separate waste goal or diversion effort?

3. Should an option within the statewide goal include composting and mulching? How would infrastructure be funded? What implementation role would the Department of Environment and Conservation have with programs and projects composting and mulching programs?

4. Should economic incentives and disincentives (implementing or decreasing/increasing tipping fee surcharges for landfills) be considered in dealing with compostable materials?

5. Should any determined goal apply to public/private entities equally? Should they apply equally to county and municipal governments?

6. Should all compostable or mulch-able materials be considered for recycling diversion and recycling?